

Claims

What is claimed is:

1. An optical identification element for identifying an item, comprising:
 - 5 an optical substrate;
 - at least a portion of said substrate having at least one diffraction grating disposed therein, said grating having at least one refractive index pitch superimposed at a common location;
 - 10 said grating providing an output optical signal when illuminated by an incident light signal;
 - said optical output signal being indicative of a code; and
 - the element being at least partially disposed on the item.
- 15 2. The apparatus of claim 1 wherein said substrate is made of a glass material.
3. The apparatus of claim 1 wherein said code comprises a plurality of bits.
4. The apparatus of claim 1 wherein the number of pitches is indicative of the number of said bits in said code.
- 20 5. The apparatus of claim 1 wherein said substrate has a length that is less than about 500 microns.
6. The apparatus of claim 1 wherein said substrate has a cylindrical shape.
7. The apparatus of claim 1 wherein said grating is a blazed grating.
- 25 8. The apparatus of claim 1 wherein said code comprises a plurality of bits, each bit having a plurality of states.
9. The apparatus of claim 1 wherein said substrate has a reflective coating disposed thereon.

10. The apparatus of claim 1 wherein said substrate is has a magnetic or electric charge polarization.

11. The apparatus of claim 1 wherein said substrate has a grating region where said grating and a non-grating region where said grating is not located; and wherein said substrate has a plurality of grating regions.

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12. The apparatus of claim 1 wherein said substrate has geometry having holes therein.

13. The apparatus of claim 1 wherein said substrate is has a geometry having protruding sections.

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14. The apparatus of claim 1 wherein at least a portion of said substrate is has an end cross sectional geometry selected from the group: circular, square, rectangular, elliptical, clam-shell, D-shaped, and polygon.

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15. The apparatus of claim 1 wherein at least a portion of said substrate is has a side view geometry selected from the group: circular, square, rectangular, elliptical, clam-shell, D-shaped, and polygon.

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16. The apparatus of claim 1 wherein at least a portion of said substrate is has a 3-D shape selected from the group: cylinder, sphere, a cube, a pyramid.

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17. The apparatus of claim 1 wherein said code comprises at least a predetermined number of bits, said number being: 3, 5, 7, 9, 10, 12, 14, 16, 18, 20, 24, 28, 30, 40, 50, or 100.

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18. An item having a optical element disposed therein, comprising:
an optical substrate;
at least a portion of said substrate having at least one diffraction grating disposed therein, said grating having at least one refractive index pitch superimposed at a common location;

the grating providing an output optical signal when illuminated by an incident light signal;

said optical output signal being indicative of a code; and
said code identifying the item.

19. A method of reading a code in an optical identification element that is disposed on an item, the element having a diffraction grating with one or more refractive index pitches superimposed at a common location, comprising:

5 illuminating said element with incident light, said substrate providing an output light signal; and

reading said output light signal and detecting a code therefrom.

20. A method for labeling an item, comprising:

10 obtaining an optical identification element having at least one diffraction grating disposed therein, the grating having at least one refractive index pitch superimposed at a common location;

the grating providing an output optical signal when illuminated by an incident light signal; and

15 the optical output signal being indicative of a code;
the element being at least partially disposed the item.

21. The method of claim 1, where the item is selected from the group, comprising: large or small objects, products, solids, powders, liquids, gases, plants, currency, ID cards, minerals, cells and/or animals.

22. The method of claim 18, where the item is selected from the group, comprising: large or small objects, products, solids, powders, liquids, gases, plants, currency, ID cards, minerals, cells and/or animals.

25 23. The method of claim 19, where the item is selected from the group, comprising: large or small objects, products, solids, powders, liquids, gases, plants, currency, ID cards, minerals, cells and/or animals.